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(54) **Video graphics systems.**

(57) A video graphics system is provided with a framestore 3 and a viewing store 10. The framestore 3 is arranged to receive new image data created by a processor 6 in response to user manipulations of a stylus/touch tablet device 1. The framestore 3 and the viewing store 10 both have the capacity to store a high definition image and to facilitate display of the image on a high definition monitor 13 the framestore is arranged to transfer only portions of its data contents to the viewing store 10 during a frame period. The portion transferred is determined by the position of the stylus on the touch tablet at the beginning of a frame period. Data in the viewing store 10 is output in faster sequence for display on the monitor 13.

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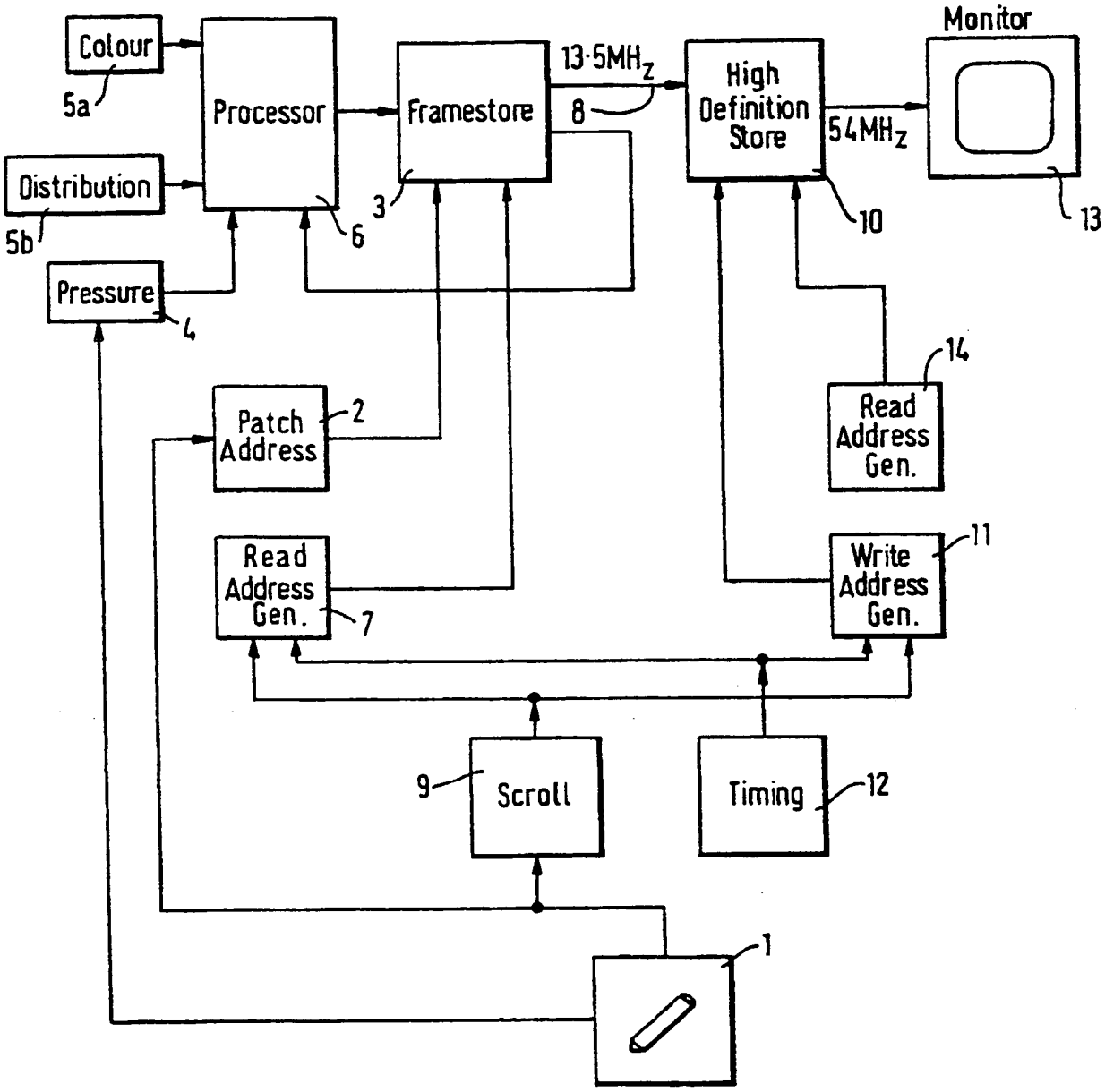
FIG.1



The present invention relates to a video graphics system.

One example of a video graphics system is described in our British Patent No. 2 089 625 and corresponding United States Patent No. 4 514 818. This system includes a touch tablet and stylus combination for generating position signals designating the position of the stylus relative to the touch tablet. The user or operator paints or draws (hereinafter referred to simply as "paints") by selecting a colour and a so called brush distribution from a range of predefined colours and distribution functions. Movement of the stylus relative to the touch tablet causes the generation of a series of position signals. The system also includes a pixel processing circuit and a frame storage means which can store an array of pixels representing a picture. On moving the stylus to designate different positions, a patch of pixels in the frame storage means referenced by each designated position is modified in response to the selected colour and distribution. All the pixels in the frame storage means, representing the picture, can moreover be read repeatedly and applied to a monitor to display the picture as it is built up by the operator.

The frame storage means for a system such as referred to in the preceding paragraph requires three ports, one for reading back pixels from the frame storage means to the processing circuit, one for writing the modified pixels from the processing circuit into the frame storage means and the third for repeatedly reading the pixels from the frame storage means to the monitor for display. Serial access is sufficient for reading the pixels as a video signal to the monitor, but random access is required via the first and second ports.

These requirements make it difficult to transfer pixels to the monitor at high rates, such as would be needed for example to refresh a monitor displaying a picture of high definition, say HDTV standard.

One object of the present invention is to reduce this difficulty.

According to the present invention in one of its aspects there is provided video graphics system in which image data is stored for manipulation in a framestore, the framestore being arranged such that user determined manipulations to the image data are effected at a rate corresponding to a low resolution and a portion of the image data including the manipulated data is output from time to time to a display store containing data representing the image for display, the area of output data updating a corresponding area of data in the display store.

According to a more particular aspect of the present invention there is provided a video graphics system comprising a display store for storing pixels representing a high definition picture, means for reading pixels from said store to provide a high definition video waveform, display means for displaying the respective picture, further storage means having capacity to store a number of pixels comparable with said high definition picture, operator responsive means for "painting" or otherwise modifying pixels in said further storage means, means for reading pixels from a movable area of said further storage means, and means for applying pixels from said area as a video waveform of lower definition than said high definition video waveform to an area of said display store which tracks said area in said further storage means, whereby the operator can observe the effect of modifying pixels using said operator responsive means.

Preferably the operator responsive means includes a stylus for referencing picture points in said further storage means at which pixel modification occurs, and the system is such that movement of the area of said further storage means from which pixels are read is stylus responsive.

The above and further features of the invention are set forth with particularity in the appended claims and together with advantages thereof will become clearer from consideration of the following detailed description of an exemplary embodiment of the invention given with reference to the accompanying drawings.

In the drawings, Figure 1 is a schematic diagram representing a video graphics system embodying the invention; and Figure 2 is a schematic diagram illustrating the manner in which image data is transferred in the system of Figure 1.

Referring now to Figure 1 of the accompanying drawings, there is shown a video graphics system comprising a stylus/touch tablet combination 1 which is arranged such that as the stylus is drawn across the touch tablet, signals XY representing the instantaneous position of the stylus on the touch tablet are output. The XY signals are applied to a patch address generator 2.

Picture point data representing an image is stored in a framestore 3 and for each XY position of the stylus, the patch address generator 2 generates, serially, a patch of picture point addresses in the framestore 3, which patch of addresses is related to the XY position of the stylus.

In addition to generating XY signals, the stylus/touch tablet combination may be arranged to generate date representing the pressure applied via the stylus to the touch tablet, such pressure related data being stored in a pressure register 4. Notional drawing implements are used to draw image data into the framestore 3 and data representing the distribution of a selected drawing implement is held in a distribution store 5a. Similarly, data representing a user selected colour is held in a colour register or store 5b.

The distribution register or store 5a is arranged to provide a distribution signal for each picture point in the patch in the framestore 3 addressed by the generator 2. During painting each addressed picture

point is read from the framestore 3 and applied to a processor 6. The processor 6, which may be of the kind described in our above mentioned patents, receives also the colour and distribution data from the respective stores 5a and 5b. The processor 6 is responsive to the pressure exerted on the stylus by the operator as represented by the pressure data in the pressure registers and uses the colour and distribution data to modify each pixel in the currently identified patch, the resulting modified pixel data being written back to their respective locations in the framestore 3. In this way pixel data representing a picture can be created in the framestore 3, or data therein can be touched up, or otherwise processed as described in the aforementioned Patents.

In the exemplary system shown in Figure 1, the framestore 3 is formed from four normal television standard three-port framestore devices which are combined to form an enlarged storage field having four quadrants, one quadrant for each of the framestore devices. Thus, the framestore 3 has the capacity to store pixel data representing up to four pictures at the resolution of the normal television standard, for example 625 lines, or to store one picture at four times normal resolution, for example HDTV standard.

A read address generator 7 generates addresses to enable the reading of pixels serially from an area in the framestore 3 sufficient to accommodate one picture at normal television resolution, which pixels are output from the framestore 3 via an output bus 8. A scroll data generator 9 also receives the XY signals from the touch tablet 1 and is arranged to generate data that causes the read address generator 7 to shift, horizontally and vertically, the area corresponding to the picture which is read from the framestore 3 to cause the area to occupy a desired position in the enlarged storage field. Thus, whilst the framestore 3 has the capacity to store an image in an enlarged storage field, the read address generator 7 is arranged to generate addresses such that only an area corresponding to an image at normal TV resolution is read from the framestore 3 during a frame period. The exact rate at which data is read from the framestore 3 will of course depend on external influences such as the standards adopted in the country in which the system is to be used, but by way of example the address generator 7 will typically generate addresses such that pixels are read from the area in the framestore 3 at a rate of say 13.5 MHz.

The picture point data or pixels read from the framestore 3 are applied to a high definition viewing store 10 which has the capacity to store pixels representing a picture of high resolution relative to the normal television standard mentioned above, for example HDTV standard. The pixels read from the framestore 3 are addressed to picture points in the viewing store 10 under the control of an address generator 11. The operation of both the read address generator 7 and the write address generator 11 is controlled by a timing circuit 12. The address generator 11 at any one time addresses only an area of the viewing store 10 occupying approximately one quarter of the storage field of this store. That is to say, the write address generator 11 addresses an area in the viewing store 11 which area is defined by a number of pixels corresponding to that in the picture read from the framestore 3. The write address generator 11 also receives scrolling data from the scroll data generator 9 and thus the address data generated by the read address generator 7 and the write address generator 11 is coordinated so that the area in the viewing store 10 to which pixel data is written tracks the area in the framestore 3 from which the reading of pixel data occurs.

The areas in the framestore 3 and the viewing store 10 are determined by the position of the stylus on the touch tablet at the beginning of each frame period, ie area reading cycle. The stylus can designate any position in the framestore 3, that is to say it can generate signals that designate any address in any of the four three-port framestore devices. At the beginning of each frame period the current address designated by the stylus is used by the scroll data generator 9 to identify the mid point of the areas in both the framestore 3 and the viewing store 10. Once the mid point has been identified the areas remain stationary until the reading cycle is completed ie until the end of the frame period and at the beginning of the next frame period. The areas are then moved by the scroll data generator 9 to the new current stylus position. As successive picture points in the viewing store 10 are addressed, the corresponding pixels output from the framestore 3 are written into the viewing store as that picture point.

A high definition read address generator 14 is arranged to generate read addresses to cause the reading of pixels from the high definition viewing store 10 for display of the high definition image on a high definition monitor 13.

Figure 2 of the accompanying drawings illustrates the way in which the position of the area addressed by the read address generator 7 changes from frame period to frame period. When the stylus is brought into contact with the touch tablet the address in the framestore 3 corresponding to the point 15 is identified and this point is used to define the centre of the area, as represented by the broken line 16-1. Movement of the stylus on the touch tablet causes data representing the stroke 17 to be drawn into the store by the processor (see Figure 1) and at the same time data is read from the area 16-1 to the corresponding area of the viewing store 10 replacing the data previously in that area. At the beginning of the next frame period t=2, the point 18 is identified as the next centre of the next area 16-2. During this next frame period t=2 data is read from the area 16-2 to a new corre-

sponding area of the viewing store 10 replacing the data previously in that area. At the same time, further movement of the stylus results in the stroke 19 being drawn into the framestore 3. During the next frame period t=3 the point 20 is identified as the centre of the area 16-3, and during creation of a stroke 21, data in the area 16-3 is written to its corresponding area in the viewing store 10. This process is repeated during each frame period with the image gradually being built up in the framestore 3 and transferred in the manner described to the viewing store 10. At the end of the fourth frame period, in the example given in Figure 2, data representing the line 22 will be held in the viewing store 10 for display on the monitor 13.

It will thus be appreciated that painting into the framestore 3 is done in the normal way by random access read-modify-write operations at normal TV rates, eg 13.5 MHz, and a portion of the image data including the modified data is transferred to the viewing store 10 also at that rate for display at high definition TV rates, eg 54 MHz. The portion or area of the image that is transferred is always centred on the position of the stylus at the beginning of a frame period and the area is sufficiently large to ensure that no normal movement of the stylus in the ensuing frame period will carry the stylus outside the defined area.

Returning now to Figure 1, it should be noted that the viewing store 10 is a two port store and it may comprise suitable Random Access Memory (RAM) devices such as a video RAM having a serial output. There is no need to provide a random access output to read from the viewing store 10. The serial output that provides the video data to the monitor 13 can therefore be rapid enough to refresh the high definition monitor 13 at the rates associated with high definition television. Thus reading may be effected to provide definition at 54 MHz for example. Indeed the monitor 13 may even be an HDTV monitor capable of accepting a video waveform at 74.25 MHz, and a definition of this order can be achieved by providing the stores 3 and 10 with sufficient picture point capacity to accommodate six images at the normal television definition.

The number of pixels in the two stores 3 and 10 need not correspond and a digital filter may be included in the bus 8, to compress the picture if the number of pixels in store 3 exceeds that in store 10, or to expand the picture if the situation is reversed.

It will be appreciated that in the example described, when painting is being effected, the updating of the picture in the store 10 is carried out within an area which moves with the stylus, the area being centred periodically (at the frame rate) at the current position of the stylus, so that updating is carried out at the area of picture within which the operator is working. For other operations, or for picture composition effects, it may be desirable to update the entire picture in the store 10 from time to time. Updating in store 10 can then be effected in four passes, occupying four frame periods and covering respectively the four quadrants of the picture.

Having thus described the present invention by reference to a preferred embodiment it is to be well understood that the embodiment in question is exemplary only and that modifications and variations such as will occur to those possessed of appropriate knowledge and skills may be made without departure from the spirit and scope of the invention as set forth in the appended claims and equivalents thereof.

Claims

1. A video graphics system in which image data is stored for manipulation in a framestore, the framestore being arranged such that user determined manipulations to the image data are effected at a rate corresponding to a low resolution and a portion of the image data including the manipulated data is output from time to time to a display store containing data representing the image for display, the area of output data updating a corresponding area of data in the display store.

2. A video graphics system as claimed in claim 1, wherein the user determined manipulations to the image data are effected in response to coordinate data representing movement of a stylus on a touch tablet.

3. A video graphics system as claimed in claim 1 or 2, wherein image data for manipulation is read from the framestore to a processor for combination thereby with other image data.

4. A video graphics system as claimed in claim 3, wherein said other image data comprises data representing the distribution of a user selected notional drawing implement and data representing a user selected colour.

5. A video graphics system as claimed in claim 3 or 4, wherein said processor is responsive to data representing pressure applied via the stylus to the touch tablet.

6. A video graphics system as claimed in claim 2, wherein said portions of image data are output from said framestore in response to address data generated by a read address generator responsive to said coordinate data from said touch tablet.

7. A video graphics system as claimed in claim 6, wherein a scroll data generator receives said

coordinate data from said touch tablet and outputs scrolling data for use by said read address generator in generating address data identifying said portions of image data in said framestore.

8. A video graphics system as claimed in claim 6 or 7 further comprising a write address generator responsive to said coordinate data for generating read address data identifying said portions of image data in said display store.

9. A video graphics systems as claimed in any preceding claim, wherein a high definition read address generator is coupled to said display store for generating address data for reading said image data therefrom for display.

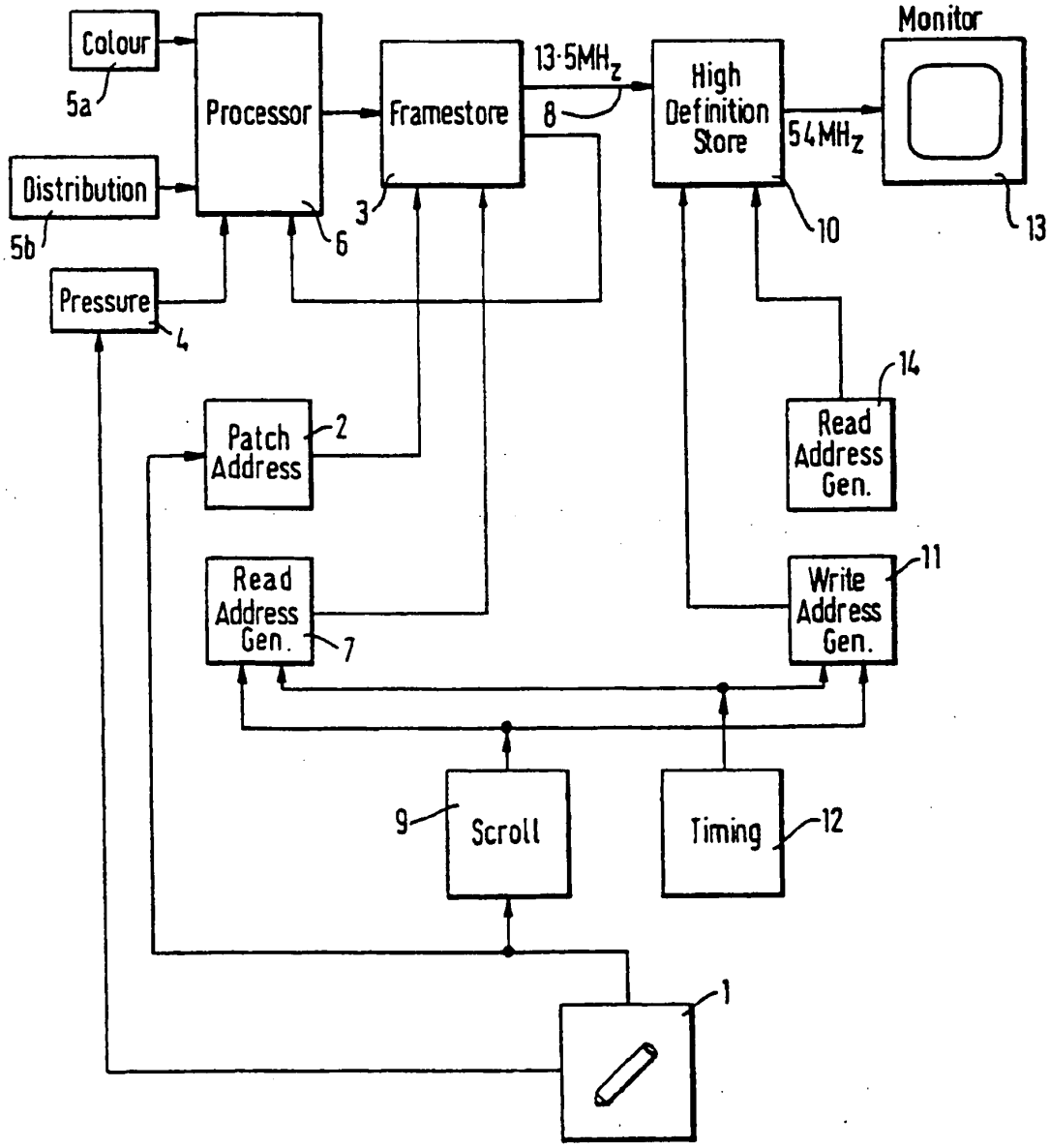
10. A video graphics system as claimed in any preceding claim, further comprising a monitor for displaying the image represented by the data in the display store.

11. A video graphics system as claimed in claim 2, wherein the area of said image data, corresponding to the portion output from said framestore, is centred on the address in the framestore corresponding to the instantaneous position of the stylus as determined from time to time.

12. A video graphics system comprising a display store for storing pixels representing a high definition picture, means for reading pixels from said store to provide a high definition video waveform, display means for displaying the respective picture, further storage means having capacity to store a number of pixels comparable with said high definition picture, operator responsive means for painting or otherwise modifying pixels in said further storage means, means for reading pixels from a movable area of said further storage means, and means for applying pixels from said area as a video waveform of lower definition than said high definition video waveform to an area of said display store which tracks said area in said further storage means, whereby the operator can observe the effect of modifying pixels using said operator responsive means.

13. A video graphics system as claimed in claim 11, wherein the operator responsive means includes a stylus for referencing picture points in said further storage means at which pixel modification occurs, and the system is such that movement of the area of said further storage means from which pixels are read is stylus responsive.

FIG.1



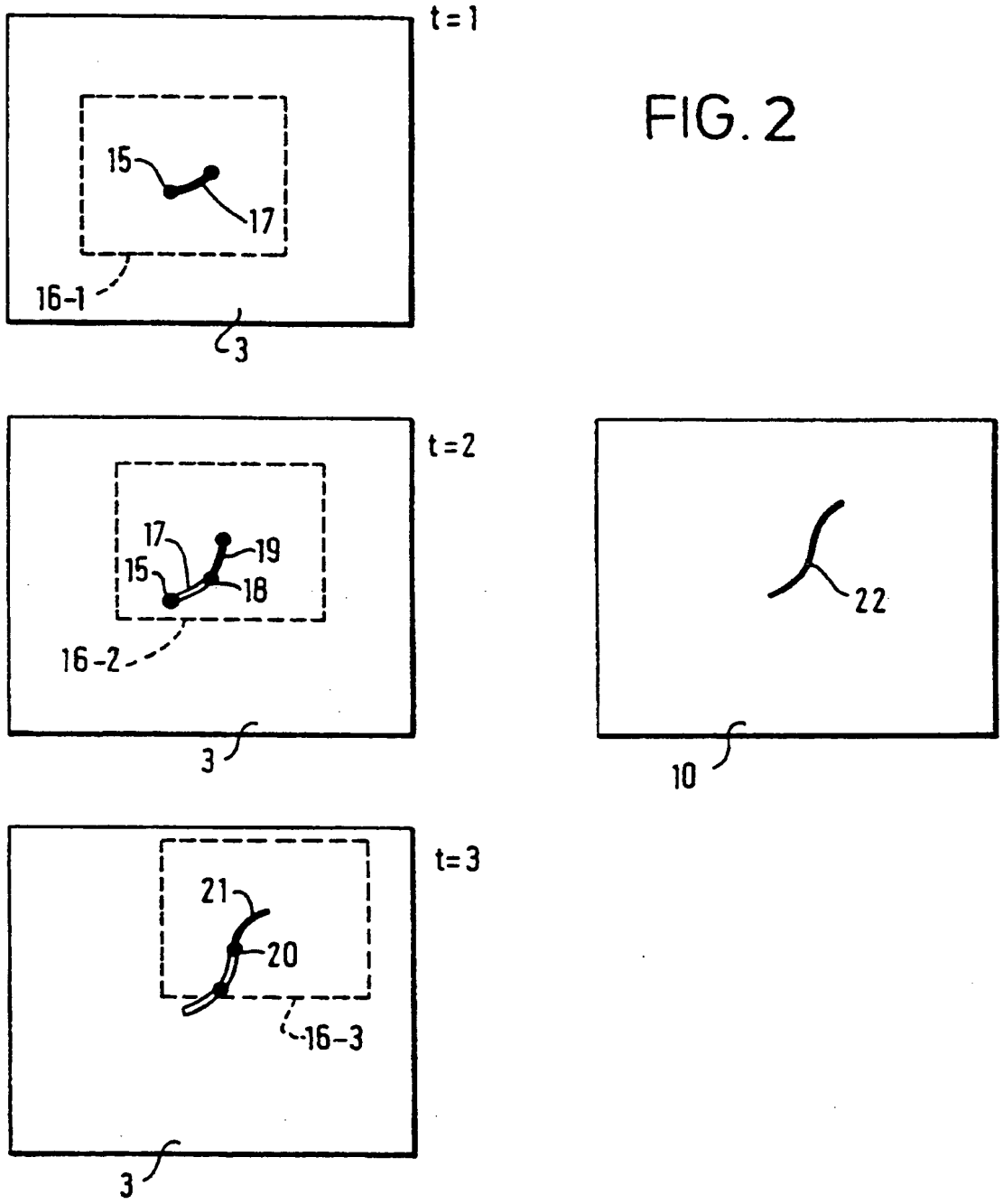
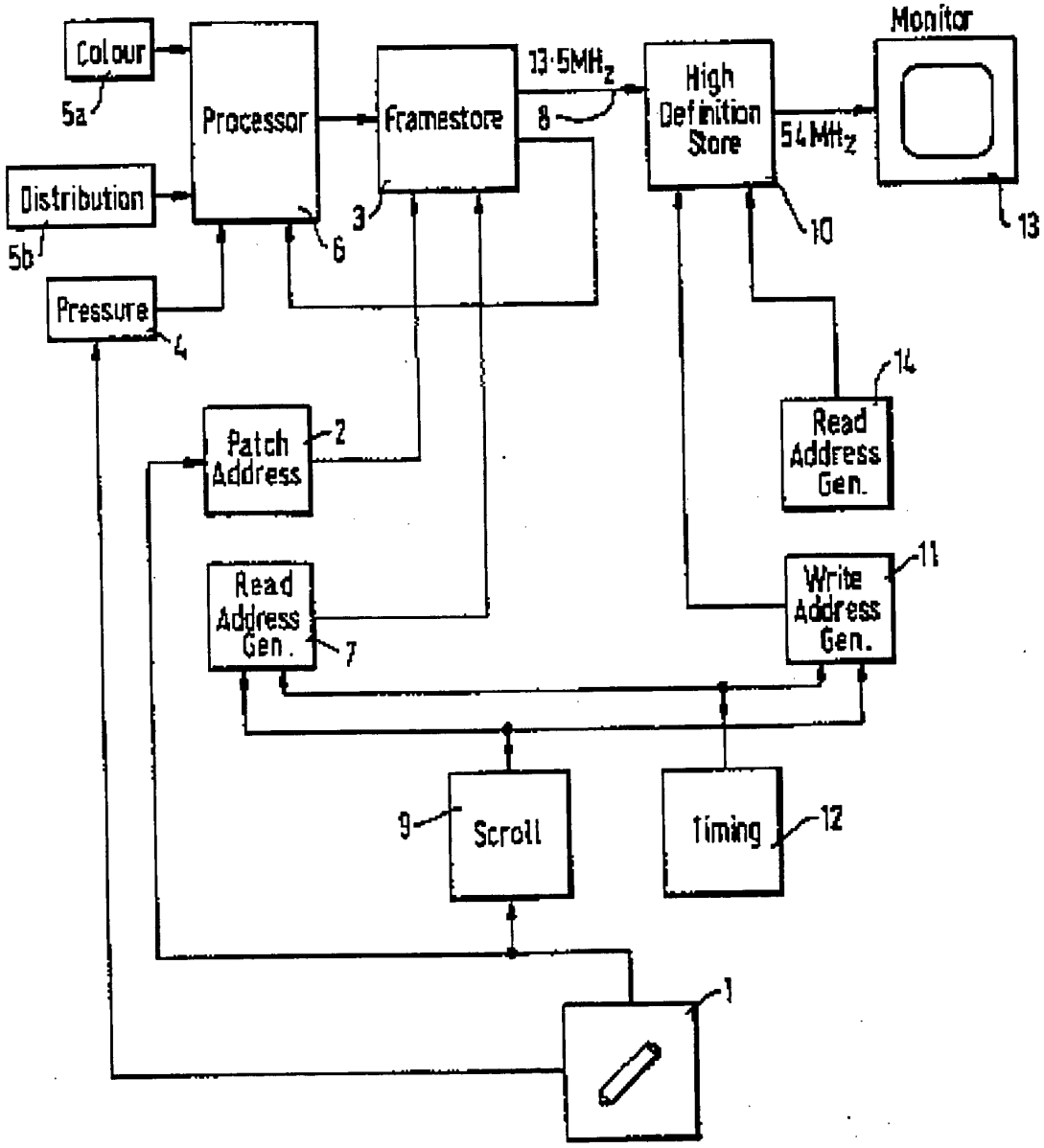


FIG. 2

FIG.1



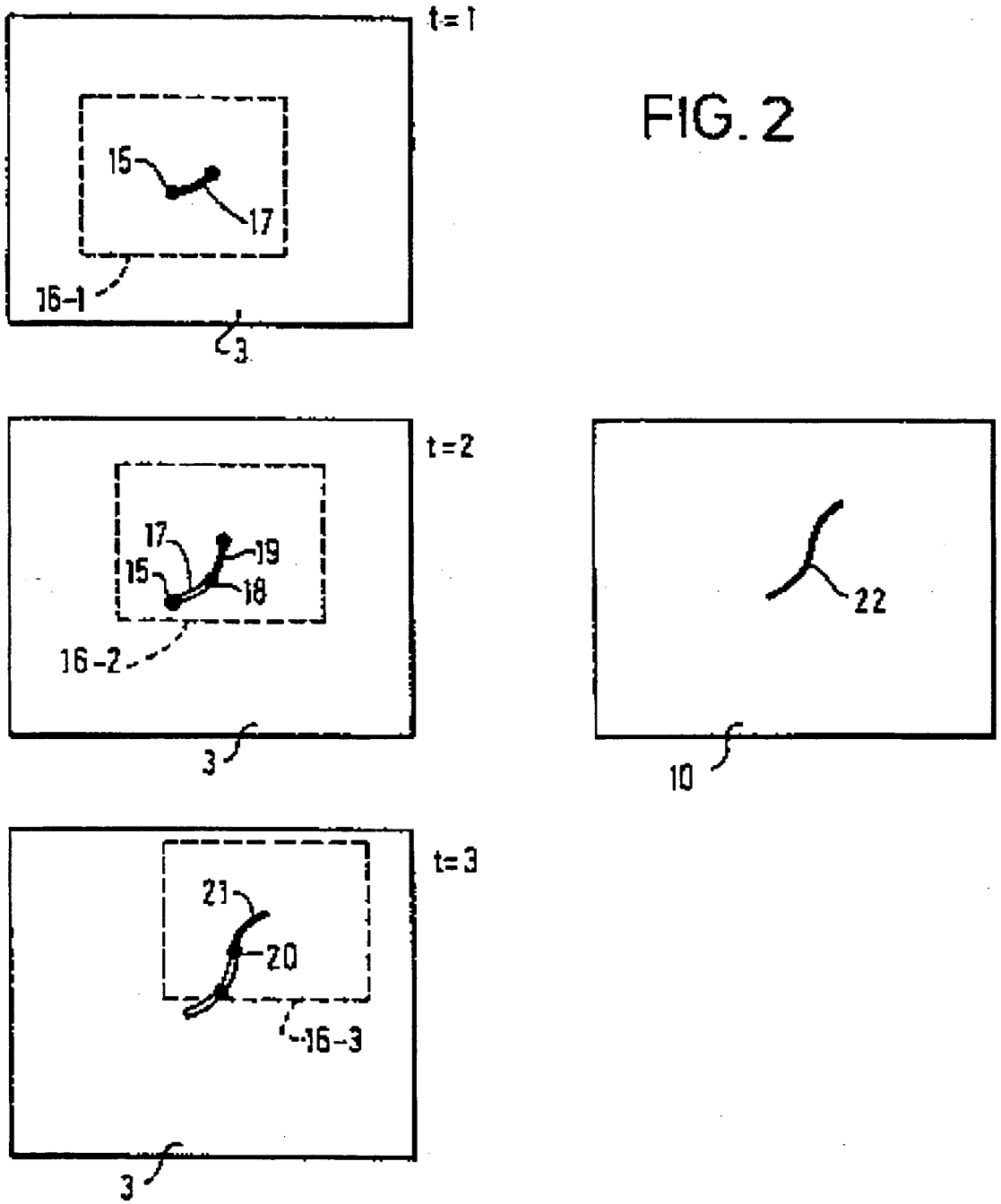


FIG. 2